

# Test Equipment Data Package Requirement and Guidelines NASA JSC RGO

## Aircraft Operations Division

## August 2005

CHANGE RECORD			
Doc. Version	Date	Process Owner/Ext.	Description
Rev B	Feb 2005	John S. Yaniec/49211	Complete Revision.
Rev B PCN 1	Aug 2005	John S. Yaniec/49211	Replace reference to AOD Form 70 with JSC-17773 and reference to AOD Form 71 with NS-STO-CH01.



National Aeronautics and  
Space Administration  
**Lyndon B. Johnson Space Center**  
Houston, Texas

Verify that this is the correct version before use.

Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B PCN 1
	Date: Aug 2005	Page 1 of 19

## APPROVAL AUTHORITIES

*Original Signed By*

---

John S. Yaniec  
Lead, Reduced Gravity Program

## NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Lyndon B. Johnson Space Center  
Houston, Texas

**Verify that this is the correct version before use.**

Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 2 of 19

## TABLE OF CONTENTS

<b>CHANGE RECORD.....</b>	<b>COVER PAGE</b>
<b>APPROVAL AUTHORITIES .....</b>	<b>1</b>
<b>TABLE OF CONTENTS .....</b>	<b>2</b>
<b>1.0 INTRODUCTION.....</b>	<b>3</b>
1.1 Purpose.....	3
1.2 Scope.....	3
1.3 References.....	3
1.4 Reduced Gravity Office Contact Information.....	3
1.5 Information on How to Apply for NASA Microgravity Research Grants.....	4
1.6 List of Acronyms .....	4
<b>2.0 TEST EQUIPMENT DATA PACKAGE REQUIREMENTS .....</b>	<b>5</b>
2.1 Timeline .....	5
2.2 Outline.....	5
2.3 Cover Page.....	6
2.4 Change Page.....	6
2.5 Quick Reference Data Sheet .....	6
2.6 Table of Contents.....	6
2.7 Flight Manifest.....	6
2.8 Experiment Background .....	7
2.9 Experiment Description .....	7
2.10 Equipment Description .....	7
2.11 Structural Verification .....	8
2.12 Electrical Analysis .....	10
2.13 Pressure Vessel/System [PV/S] for Reduced Gravity Flight Documentation .....	12
2.14 Laser Certification .....	13
2.15 Parabola Details and Crew Assistance.....	14
2.16 Institutional Review Board .....	14
2.17 Hazard Analysis Report Guidelines.....	14
2.18 Tool Requirements.....	15
2.19 Photo Requirements .....	15
2.20 Aircraft Loading.....	16
2.21 Ground Support Requirements .....	16
2.22 Hazardous Materials .....	16
2.23 Material Safety Data Sheets.....	17
2.24 Experiment Procedures Documentation .....	17
2.25 Bibliography .....	18
2.26 Exceptions/Deviations/Waivers.....	18

## LIST OF TABLES

Table 1. Example Load Table.....	11
Table 2. Pressure System Design Specifications Example.....	13

**Verify that this is the correct version before use.**

Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B PCN 1
	Date: Aug 2005	Page 3 of 19

## 1.0 INTRODUCTION

The Reduced Gravity Program, operated by the National Aeronautics and Space Administration (NASA), Lyndon B. Johnson Space Center (JSC) in Houston, Texas, provides a “weightless” environment, similar to the environment of space flight.

### 1.1 Purpose

The purpose of this guide is to provide a guideline for existing and potential users of the Reduced Gravity Program. This document explains the Test Equipment Data Package, and provides information on pre-flight, post-flight, and in-flight test operations.

### 1.2 Scope

This work instruction applies to all users and potential users of the Johnson Space Center (JSC) Reduced Gravity Program.

### 1.3 References

[American National Standards Institute \(ANSI\) Z-136.1 Safe Use of Lasers](#)  
[AOD 33897, Experiment Design Requirements and Guidelines NASA 932 C-9B](#)  
[AOD 33912, Interface Control Document NASA 932 C-9B](#)  
[AOD Form 72, C-9 Quick Reference Data Sheet](#)  
[AOD Form 150, Human Research Master Protocol](#)  
[AOD Form 151, NASA/JSC Human Research Informed Consent](#)  
[JSC Form 8500, Report of Medical Examination](#)  
[JSC-17773, Preparing Hazard Analyses for JSC Ground Operations](#)  
[JSC-20483, JSC Institutional Review Board – Guidelines For Investigators Proposing Human Research For Space Flight And Related Investigations](#)  
[NS-STO-CH01, General Hazard Identification Checklist](#)  
[Standard Form 88, Medical Record – Report of Medical Examination](#)  
[Standard Form 93, Report of Medical History](#)

### 1.4 Reduced Gravity Office Contact Information

Any questions concerning this document, the program, test requirements, test schedules, etc., should be directed to:

Reduced Gravity Office  
Building 993  
Ellington Field  
Houston, Texas 77034  
Call 281-244-9874, fax 281-244-9500 or E-mail: [zerogl@jsc.nasa.gov](mailto:zerogl@jsc.nasa.gov)

**Verify that this is the correct version before use.**

<b>Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO</b>	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 4 of 19

## **1.5 Information on How to Apply for NASA Microgravity Research Grants**

Researchers interested in conducting Reduced Gravity research aboard the C-9B Reduced Gravity Aircraft must have a NASA grant or be sponsored by NASA or another federal government agency. Information on how to apply for a NASA grant in the areas of Life and Material Sciences can be found at: <http://research.hq.nasa.gov/research.cfm>

## **1.6 List of Acronyms**

ANSI	American National Standards Institute
CG	Center of Gravity
COTS	Commercial Off the Shelf
DOT	Department of Transportation
FBD	Free Body Diagram
FS	Factor of Safety
IRB	Institutional Review Board
JSC	Johnson Space Center
MAWP	Maximum Allowable Working Pressure
MSDS	Material Safety Data Sheet
NASA	National Aeronautics and Space Administration
RGO	Reduced Gravity Office
TPS	Test Preparation Sheet
TRR	Test Readiness Review
URL	Uniform Resource Locator

**Verify that this is the correct version before use.**

Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 5 of 19

## 2.0 TEST EQUIPMENT DATA PACKAGE REQUIREMENTS

The following provides a detailed description of the documentation required in the Test Equipment Data Package. A Test Equipment Data Package must be prepared for each experiment proposed for flight on the C-9B.

It is imperative that all sections be addressed as being applicable or non-applicable. The Test Equipment Data Package requirements documentation should be concise, yet thoroughly explain the experiment.

### 2.1 Timeline

The Test Equipment Data Package must be thoroughly completed in accordance with these guidelines and submitted to the Reduced Gravity Office (RGO) (e-mail to [zerogl@jsc.nasa.gov](mailto:zerogl@jsc.nasa.gov) or submit 7 paper copies) no later than six weeks prior to first flight.

#### NOTE

Any changes to an experiment which occur after the Test Equipment Data Package has been submitted will be evaluated on a case by case basis.

Errata should be submitted as timely as possible to the RGO. The RGO will make every effort to evaluate and subsequently accept late changes if possible. However, the RGO cannot guarantee approval before the originally scheduled flight dates.

### 2.2 Outline

The Test Equipment Data Package must follow the section-order presented below:

1. Cover Page
2. Change Page
3. Quick Reference Sheet
4. Table of Contents
5. Flight Manifest
6. Experiment Background
7. Experiment Description
8. Equipment Description
9. Structural Verification
10. Electrical Analysis
11. Pressure Vessel or System
12. Laser Certification
13. Parabola Details and Crew Assistance Required

**Verify that this is the correct version before use.**

<b>Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO</b>	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 6 of 19

14. Free Float Requirements
15. Institutional Review Board (IRB)
16. Hazard Analysis
17. Tool Requirements
18. Photo Requirements
19. Aircraft Loading
20. Ground Support Requirements
21. Hazardous Material
22. Material Safety Data Sheets (MSDS)
23. Procedures
24. Bibliography

The remainder of this document provides detailed writing instructions for each section of the Test Equipment Data Package.

### **2.3 Cover Page**

The cover page to the Test Equipment Data Package must contain the principal investigator's name, research organization, and contact information (e-mail address, phone number, and mailing address), the experiment's title, and the date the package was completed.

### **2.4 Change Page**

A change page must be included in the document. Any content changes since the last submission to the RGO should be noted, referenced, and dated along with the change authority signature.

### **2.5 Quick Reference Data Sheet**

The [AOD Form 72](#), Quick Reference Data Sheet should be completed in the format shown by selecting the link and included as a dedicated page.

### **2.6 Table of Contents**

The Table of Contents shall list the sections of the Test Equipment Data Package with corresponding page numbers. All pages of the Test Equipment Data Package shall be numbered sequentially.

### **2.7 Flight Manifest**

The Flight Manifest section should list the number of personnel required for each flight, names of all potential flight personnel, and any additional personnel that may support on site.

**Verify that this is the correct version before use.**

<b>Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO</b>	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 7 of 19

## 2.8 Experiment Background

This section of the Test Equipment Data Package should briefly describe why this experiment is being flown on the C-9B. It should be noted whether the experiment is a follow-up of a previous experiment, a preliminary step to a future experiment, or related to a space flight experiment. Also include the name(s) of any supporting NASA organization or program.

## 2.9 Experiment Description

This section of the Test Equipment Data Package shall briefly explain the experiment and should be written so that a practicing engineer or scientist can understand the experiment. Science (or engineering) goals, and expected or actual results, for accompanying ground-based experiments should also be presented here only if applicable to safe successful flight.

## 2.10 Equipment Description

This section shall describe the equipment required for performing the experiment.

### 2.10.1 This section must include all reduced gravity flight and ground-based equipment.

Drawings or photographs of the equipment should be included, where available, along with text description.

Dimensions and weights for the overall experiment shall be included here. This should be further broken down by major subassemblies that will be secured on the aircraft as distinct items.

The type of hardware must be stated (i.e., Class I, II, III, GSE, etc.).

Type	Description	Considerations
Class 1	Space Flight Hardware	Controlled hardware, Requires Quality Assurance, Requires Controlled Storage, Requires Class 2 or better interface.
Class 2	Controlled Hardware of Flight Design	Controlled hardware, Requires Quality Assurance, Requires Controlled Storage,
Class 3	Uncontrolled Hardware of Flight Design	No special Requirements
Experimental	Test Equipment for Ground or Reduced Gravity Flight	No special requirements
Ground Support Equipment	May or May not be Controlled	May Require QA Support if Interfacing to Class 1 or 2 Hardware.

**Verify that this is the correct version before use.**



Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 8 of 19

- 2.10.2 A proposed layout of the equipment on the aircraft for takeoff and landing shall be included in this section. A layout describing the in-flight configuration of the hardware during parabolas should include placement of required operators.
- 2.10.3 Any component with special handling requirements or special hazards must be described in detail.
- 2.10.4 All items to be taken on-board the aircraft during flight must be listed in this section, including cameras, outreach experiments, tools ([see Section 2.18](#)), personal items and mementos, etc.
- 2.10.5 Any special requirements (in-flight or ground based) shall also be described here.
- 2.10.6 Please state whether or not the experiment will free float at any time. Identify the subassemblies that will free float and handling provisions.

## 2.11 Structural Verification

Follow the guidelines below to meet the documentation requirements for the structural verification section of the Test Equipment Data Package. Appropriate methods, or combinations of methods, are required for verifying the structural integrity of in-flight equipment during take-off and landing (configurations) only.

RGO suggests researchers adequately verify integrity of their hardware given the estimated in-flight loads during the parabolic phase of flight. However, this is not required.

### 2.11.1 Analysis Method

1. Submit free body diagrams (FBDs) for all g-load conditions listed in the Structural Design Requirements Section of this guide. (FBDs are sketches used to dimensionally locate where g-loads are applied on test equipment.) G-loads will be applied at equipment centers of gravity (CGs).
2. Create a table documenting individual component weights and overall assembly weight. Specify all materials used for test equipment fabrication and their respective allowable load. Specify all fasteners used, weld types (associated de-rating and/or post process or inspection for welds must be included), and their location on the test equipment assembly (this is best accomplished by using a table, detailed drawing/schematic, and/or digital pictures).
3. Submit all design calculations showing comprehensive compliance with all experiment structural design requirements on:
  - a. The attachment of components to the frame (prove all components will remain intact and attached to the experiment frame under the g-loads specified in the Structural Design Requirements Section).

**Verify that this is the correct version before use.**

<b>Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO</b>	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 9 of 19

- b. The full assembly (prove the frame will withstand the g-loads specified in the Structural Design Requirements Section, induced from its own mass and those masses of the components attached to it, without permanent deformation).
  - c. The floor attachment of the experiment to the aircraft floor (see [AOD 33897, Experiment Design Requirements and Guidelines NASA 932 C-9B](#) Section 2.1 for g-loads and allowable aircraft mounting hardware).
  - d. If applicable, design calculations proving free-floated hardware can withstand 3 g's in any direction for parabolic phase of flight.
  - e. The floor load analysis (prove that equipment will not exceed aircraft allowable floor load for hard landing case and aircraft loading/unloading).
4. Provide a table that displays the factor of safety/margin of safety result from each structural analysis performed. Label the load case analyzed (i.e., 9g forward load), location of the analysis on the experiment assembly (i.e., laptop computer bracket attachment), and calculated factor of safety or margin of safety.

#### **NOTE**

If analysis is performed by a qualified engineer, only the signed (by said engineer) FS Table mentioned above is required to be submitted in the TEDP. Supporting data should be available upon request.

#### 2.11.2 Test or Demonstration

Components may be load-tested, at appropriate locations, using a properly calibrated tension gauge to simulate g-loads on equipment.

This can be used for the structural verification of lightweight components in determining whether or not attachment brackets can withstand structural design requirements.

It is not recommended that this be performed on full assemblies, without detailed conditions and assumptions listed.

To properly document pull tests, address the following questions:

1. How was the test performed (include schematics if necessary)?
2. What test equipment was utilized and how was it calibrated?
3. Who performed the test and when (include certifications of individuals performing/verifying test)?
4. Copies of applicable documentation (TPSs, etc.)
5. Provide a table that displays the factor of safety/margin of safety result from each structural test performed. Label the load case analyzed (i.e., 9g forward load), location of the load on the experiment assembly (i.e., laptop computer bracket attachment), and calculated factor of safety or margin of safety.

**Verify that this is the correct version before use.**

<b>Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO</b>	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 10 of 19

#### **NOTE**

If test is performed by a qualified engineer/technician, only the signed (by said engineer/technician) FS Table mentioned above is required to be submitted in the TEDP. Supporting data should be available upon request.

## **2.12 Electrical Analysis**

All experiments that use any type of electrical power (including battery power) must provide an electrical analysis formatted in three parts: Schematic, Load Table and Emergency Shutdown Procedures.

### **2.12.1 Schematic**

The analysis should provide a graphical schematic drawing that clearly details the top-level (not the inner circuitry of each component, but the interaction of each component at the box level) electrical design of the experiment. The schematic should include the following:

1. All wiring and electrical devices (including COTS)
2. Each power cord from an aircraft power distribution panel
3. Which aircraft outlets are used, and the voltage and current draw on each outlet (Nominal and Peak current drawn by experiment, not that provided by the airplane)
4. A unique identifier (such as a number) matching the actual label on each wire, or wire bundle
5. The gauge number and current carried on each wire (Nominal and Peak current values)
6. A current limiting device and its limiting value for each power cord (ideally, a current limiting device would be installed on each electrical component)
7. A master “kill switch”
8. The grounding method used to bond exposed metal surfaces and compatibility with Ground Fault Circuit Protection.

### **2.12.2 Load Tables**

All experiments that use electrical power must provide a Load Table for each power source.

**Verify that this is the correct version before use.**

Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 11 of 19

#### NOTE

Manufacturer supplied batteries used to power camcorders, laptop computers or similar devices should be described in the electrical analysis. A Load Table is not required as long as the device is operated from the battery and the Commercial Off the Shelf (COTS) items are being used as designed and have not been modified. A Load Table is required when an AC adapter is used to power the device.

The purpose of a Load Table is to describe the electrical power drawn from each power source and ensure that the source is not overloaded. In the interests of safety, battery powered experiments should complete a Load Table as well.

One Load Table must be provided for each power source in an experiment. For example, if two power cords are driven by an aircraft power distribution panel, then two Load Tables should be completed. If a six-volt battery is used to power part of the experiment, a third Load Table should be completed to describe that circuit as well.

Each table shall provide a description of the power source including the operating voltage and the rated current. The table must provide a detailed list of each load device and the *maximum* current draw of each device. The sum of the *maximum* device currents must not exceed the rated current of the power source (or circuit breaker value).

Ideally, each circuit should be designed so that the total *nominal* current of all devices does not exceed 80 percent of the rated supply current.

#### 2.12.2.1 Example

An example Load Table is given in [Table 1](#). One power cord is used to run the experiment from an aircraft power distribution panel. The cord is plugged into the 115 Volt AC outlet that is circuit breaker protected to 20 Amps on the panel. The cord has a wire gauge (size) of 12. The power source in the example (the aircraft outlet) is used to run four devices, as shown on the right hand column of the table. The total *maximum* current draw of all devices is at the bottom of the column. The total *maximum* current draw must not be greater than the rated current of the supply outlet. Again, each circuit should be designed so that the total *nominal* current of all devices does not exceed 80 percent of the rated supply current.

**Table 1. Example Load Table**

Power Source Details	Load Analysis
Name : Power Cord A	Widget 1 - 1 Amp
Voltage : 115 VAC, 60 Hz	Widget 2 - 5 Amps
Wire Gauge : 12	Widget 3 - 5 Amps
	Widget 4 - 2 Amps
Max Outlet Current: <b>20 Amps</b>	Total Current Draw: <b>13 Amps</b>

**Verify that this is the correct version before use.**

Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 12 of 19

#### 2.12.2.2 Stored Energy

The analysis must describe any devices used to build a large electrical charge (such as large capacitors or wire coils). The description should provide the maximum voltage of the charge and explain how this energy will be dissipated in the experiment.

#### 2.12.3 Electrical Kill Switch

Finally, each experiment must have emergency shutdown capabilities. A detailed description of the Electrical Shutdown Procedures must be provided in the electrical analysis. The procedures shall describe the “kill switch” incorporated into the design as well as the experiment’s reaction to a power loss.

#### 2.12.4 Loss of Electrical Power

In the event of electrical power loss (expected or unexpected), all experiments must fail to a safe configuration.

Researchers should be prepared to demonstrate their experiment’s emergency shutdown capability at the Test Readiness Review (TRR).

### 2.13 Pressure Vessel/System [PV/S] for Reduced Gravity Flight Documentation

All required documentation must be complete prior to the first operation on NASA facilities, and be included in the Test Equipment Data Package. Typically, the PV/S will be operated at TRR within normal limits. Should mission specific parameters prohibit demonstration, an RGO Waiver to Requirement may be applied for at the time of TEDP submission.

1. Brief description of PV/S purpose, major components of subassemblies, working fluid(s) and volumes, general operating procedure.
2. System Schematic, numbered to correspond to associated component table.
3. Component table (Table 2) listing individual components and associated specifications.
4. Detailed Drawings of *non-commercially* produced components and subsystems.
5. Provide calculations and associated assumptions of *non-commercially* produced components and subsystems.
6. Include records of certifications, inspections, and due dates for tested components.

Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 13 of 19

**Table 2. Pressure System Design Specifications Example**

Schematic Reference #	Component Description	MAWP (psi)	Relief Valve Setting (psi)	Regulator Setting (psi)	Built By	Cert. Test/Calib. Date	Proof Test – Certified By
1*	Nitrogen K bottle	2200	N/A	N/A	ACME, Inc.	May 2, 1999	On “k” bottle DOT sticker
2	Regulator	3000	N/A	200	PDT Co.	Aug 1, 1999	AJN
3	Pressure Relief Valve	500	220	N/A	E & A Indus.	Dec 31, 1999	AJN
4	Stainless Steel Tub	3000	N/A	N/A	M & K Products	May 15, 1999	P – BCH**
5	Reaction Chamber	250***	N/A	N/A	Organization Design	Oct 9, 1999	H – AJN**

\* The number “1” identifies the component labeled “1” on the pressure/vacuum system schematic.

\*\* The “H – AJN” indicates that a hydrostatic proof-pressure test was performed on the reaction chamber by AJN on October 9, 1999. The “P” shown for component 3 indicates a pneumo-static proof-pressure test was performed.

\*\*\* The value of 250 MAWP for the reaction chamber is the maximum allowable working pressure (MAWP) designated to that component by engineering analysis. If this component were to be operated using a higher pressure, its factor of safety would be decreased beyond a minimum of 4. Therefore, this system must never be operated at pressures above the lowest MAWP found in the table.

## 2.14 Laser Certification

The following information must be documented in the laser certification section of the Test Equipment Data Package and submitted to the RGO six weeks prior to the scheduled flight date.

1. State what class of laser is being used with the experiment
2. For all lasers, submit the following information
  - a. Laser class, type, and manufacturer
  - b. Brief description of the laser’s purpose
  - c. Address when the laser will be used during the flight, and for what duration
  - d. Description of the containment controls (i.e., describe the protective housing, interlock switches, emergency kill switch, temperature/fire control, protective eyewear, etc.)
3. For lasers categorized in classes 3 and 4, submit the following additional information:
  - a. Detailed description of the laser hardware
  - b. Description of the laser parameters
  - c. Description of the operating and alignment procedures
  - d. Description of the operators’ training and experience level
  - e. Description of the medical surveillance requirements.

**Verify that this is the correct version before use.**

Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B PCN 1
	Date: Aug 2005	Page 14 of 19

## 2.15 Parabola Details and Crew Assistance

In this section, provide all details on parabola requirements for the flight week(s).

Identify what levels of reduced (or hyper) gravity will be required (i.e., 0, 0.16, 0.38, etc). Indicate how many of each type per mission will be required and at what interval. Keep in mind that flights normally include 10 parabolas per set with a 2 to 3 minute break in between parabola sets.

It is generally helpful to identify and distinguish between hard parabola requirements, and those that are desired.

State any crew assistance that may be required, both on the ground and during flight, such as free floating an experiment, medical surveillance, etc.

## 2.16 Institutional Review Board

Test developers who plan research involving human test subjects, animal test subjects, or biological tests must obtain approval from the JSC IRB. See [JSC-20483, JSC Institutional Review Board: Guidelines for Investigators Proposing Human Research for Space Flight and Related Investigations](#),” for details on the IRB process.

Twenty copies of a completed [AOD Form 150](#), Human Research Master Protocol must be submitted to JSC at least six weeks prior to the proposed flight.

This protocol must include the equipment safety certification described in the following section, and applicable signed consent forms for each subject (included in [AOD Form 151](#), NASA/JSC Human Research Informed Consent. In addition to equipment safety certification, letter(s) of approval from other IRBs and/or Institutional Animal Care Use Committees is required. All signed NASA/JSC Human Research Informed Consent forms must include a Layman’s Summary of the experiment.

The JSC IRB meets at least once a month with additional meetings scheduled at the call of the Chair. [JSC Form 8500 – Report of Medical Examination](#), [Standard Form 88 – Medical Record - Report of Medical Examination](#), or [Standard Form 93 – Report of Medical History](#) should be submitted to:

JSC Institutional Review Board Mail Code SA  
Lyndon B. Johnson Space Center  
Houston, Texas 77058

## 2.17 Hazard Analysis Report Guidelines

These guidelines are intended to help the test developer identify hazards in the test equipment and procedures, and prepare the hazard analysis required for the Test Equipment Data Package.

The basic purpose of the Hazard Analysis Report section is to document the safety analysis performed to ensure all potential hazards have been addressed, and adequate controls have been implemented.

Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B PCN 1
	Date: Aug 2005	Page 15 of 19

The preparation of the Hazard Analysis Report must be consistent with JSC Safety and Health Handbook, [JSC 1700.1 Section 2.4](#), should begin during the conceptual phase of the experiment as hazards are identified and should continue throughout the experiment's life cycle.

The report should be of sufficient depth and detail so that technical personnel can determine if adequate hazard elimination or control has been accomplished or if additional hazard resolution analysis is required.

#### NOTE

The Hazard Analysis Report must be updated whenever changes to experiment design or operations affect a hazard condition.

The Hazard Analysis Report consists of the [General Hazard Identification Checklist](#) and [JSC-17773](#), Preparing Hazard Analyses for JSC Ground Operations.

## 2.18 Tool Requirements

In this section, include information regarding the tools that will be brought to the Reduced Gravity facility, tools that will be used on the airplane, and descriptions of the [tools](#) that will be borrowed from the RGO.

#### NOTE

No tools or loose items of any type may be brought onto the aircraft at anytime without approval of an RGO Test Director.

Include information on how the tools will be controlled, contained, inventoried, and identified (note that each tool must be marked to indicate its owner).

Tools needed for flight shall be identified during the TRR briefing for approval and a copy of the tool inventory provided to a Test Director prior to each flight.

A Test Director must approve all changes to the tool list prior to flight.

## 2.19 Photo Requirements

This section should indicate all photographic (still and video) requests for the documentation of the experiment.

1. Still and/or Video Photographers
2. Should the experiment require the S-band downlink, the researcher is responsible for the additional cost. Arrangements for use of the S-band downlink must be made with the RGO **six weeks** ([zerogl@jsc.nasa.gov](mailto:zerogl@jsc.nasa.gov)) prior to the researcher's arrival at Ellington Field.
3. Indicate how many fixed camera poles will be required to mount video equipment for sufficient documentation of the experiment
4. Indicate the product format and quantities of the imagery requested.

**Verify that this is the correct version before use.**



<b>Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO</b>	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 16 of 19

## **2.20 Aircraft Loading**

Please document requirements for the Aircraft Loading in this section of the Test Equipment Data Package.

1. State what type of ground equipment will be needed to load the experiment into the airplane (i.e., forklift, lifting pallet, J-bars, High Lift Truck, etc.)
2. Describe the hardware manipulation strategy on the ground and in the C-9B test cabin (i.e., lifting handles, casters, etc.). If lifting is required, handles must be available for enough personnel to limit the load to 50 lbs per person.
3. List the weights of the sub-assemblies that are to be loaded onto the aircraft. State the base plate area for each assembly in square feet. Calculate and document the amount of load that will be placed on the aircraft floor in pounds per square foot during loading operations. If casters or J-Bars are to be used, calculate and document the weight that will be loaded on each wheel. The RGO will determine if shoring is necessary and will be responsible for implementing all shoring procedures.

## **2.21 Ground Support Requirements**

In this section of the Test Equipment Data Package, describe what will be needed, in terms of ground support, from the RGO. Please address the following, but not limited to:

1. Type of power will be needed on the ground for testing and support of research equipment.
2. Indicate the type and total number of K-bottles that will be required for ground and flight operations (indicate per mission requirements as well). K-bottles can be delivered to the:  
  
Reduced Gravity Office  
Building 993, Ellington Field  
Houston, Texas 77034
3. Indicate any chemicals that are toxic and/or corrosive to be mixed and/or stored on base.
4. Indicate if access to building 993 (the RGO) during hours other than normal business hours (0730-1600) is required.
5. Indicate specific tool requests or needs for special ground handling equipment.

## **2.22 Hazardous Materials**

Please state whether or not the experiment will be using any toxic, corrosive, explosive, and/or flammable materials.

Describe what the material is, how it will be used, and quantities being used.

Early contact with the RGO and the JSC Safety Office for discussions on proper use and containment of proposed hazardous materials may prevent delays in getting approval for the use of such materials.

**Verify that this is the correct version before use.**

Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 17 of 19

## 2.23 Material Safety Data Sheets

In this section of the Test Equipment Data Package, include the [MSDS](#) sheets that apply to any chemical, fluid, etc. that the experiment utilizes.

MSDS sheets must be provided for all chemicals taken onto JSC property. Copies of MSDS sheets must be kept with the chemicals at their ground-based storage areas.

## 2.24 Experiment Procedures Documentation

The information presented in this section of the Test Equipment Data Package will describe all of the procedures involved with operating the experiment at Ellington Field. These procedures should be comprehensive, beginning with the hardware arrival at Ellington Field and concluding with its shipment from Ellington Field. These procedures should be broken down in the following order:

### 1. Equipment Shipment to Ellington Field

State how equipment will be shipped, when it will be shipped, and what storage requirements are needed at Ellington Field to safely store your hardware.

The researchers are responsible for all equipment sent to and from Ellington Field. The RGO will not be responsible for any shipping arrangements.

Please see [AOD 33899, JSC Reduced Gravity Program User's Guide](#), Section 3.3 for additional information on the shipping and receiving of equipment to/from Ellington Field.

### 2. Ground Operations

State the procedures proposed to set-up and operate your equipment on the ground at Ellington Field.

List the ground facilities/equipment required at Ellington Field to operate your equipment.

### 3. Loading/Stowing

State the procedures proposed to load your equipment onto the aircraft .

Include a Lift Plan in this section identifying lift/no lift points and method.

Include a Stowage Plan (diagram) in this section to include number, type, and placement (length, angles, etc.) of cargo securing devices (straps, bolts, etc).

### 4. Pre-Flight

State the procedures proposed for pre-flight operations. Are there any special requirements regarding cabin temperatures, power availability, in-flight storage space, etc.?

### 5. Take-off/Landing

State any special procedures proposed during take-off and/or landing operations. Will there be any special equipment stowage requirements during take-off and landing? Will there be any power requirements during take-off and landing?

**Verify that this is the correct version before use.**

<b>Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO</b>	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 18 of 19

**6. In-Flight**

Provide a checklist including all procedures proposed for parabolic maneuvers, including just prior to and after parabolas. Include emergency procedures in this section.

**7. Post-Flight**

State any special procedures proposed for readying equipment for the next day's flight.

**8. Off-Loading**

State any special procedures proposed for off-loading the equipment from the C-9B. State the shipping arrangements that have been made for the removal of equipment from NASA property.

**9. Emergency/Contingency**

Provide off nominal, contingency, and emergency procedures. Include actions by researchers as well as NASA Aircrew. Include specific firefighting procedures.

**2.25 Bibliography**

Please list any resources (include title, originator, and date) that were referenced in writing the Test Equipment Data Package. Provide footnotes in the body of the Test Equipment Data Package to designate where references were used. For each resource referenced in the bibliography, indicate volumes, chapters, pages, Uniform Resource Locator (URL) addresses, etc.

**2.26 Exceptions/Deviations/Waivers**

List any and all exceptions or waivers to, deviations from, any RGO (or referenced) documented requirement and/or guideline that is being applied for. Include requirement, rationale, description and prior approval or precedence if applicable.

Submit a separate request for each instance to the RGO for disposition.

<b>Aircraft Operations Division Test Equipment Data Package Requirement and Guidelines NASA JSC RGO</b>	Doc. No. AOD 33896	Rev. B
	Date: Feb 2005	Page 19 of 19

## INDEX

"zerog1@jsc.nasa.gov", 3, 5	Laser, 5, 13
Aircraft Loading, 6, 16	Load Tables, 10
at Ellington Field, 17	Material Safety Data Sheets (MSDS), 17
Bibliography, 18	Parabola Details and Crew Assistance, 14
Building 993, 3, 16	Photo Requirements, 15
C-9B, 4, 5, 7, 16, 18	Pressure Vessel/System [PV/S] for Reduced Gravity Flight Documentation, 12
Cover Page, 6	Purpose, 3
Electrical, 5, 10, 12	Quick Reference Data Sheet, 6
electrical power loss, 12	Reduced Gravity Office, 3, 4, 5, 13, 15, 16, 17
Ellington Field, 3, 15, 16, 17	Reduced Gravity Office Contact Information, 3
Equipment Description, 7	S-band downlink, 15
Experiment Description, 7	Schematic, 10
Experiment Procedures Documentation, 17	Scope, 3
Flight Manifest, 6	Structural Verification, 8
forklift, 16	Table of Contents, 6
Free Float, 6	Test Equipment Data Package, 3, 5, 6, 7, 8, 12, 13, 14, 16, 17
Ground Support Requirements, 16	Test Equipment Data Package Requirements, 5
Hazard Analysis Report Guidelines, 14	Test Readiness Review, 12
Hazardous Materials, 16	Tool Requirements, 15
Human Research Master Protocol, 3, 14	zerog1@jsc.nasa.gov, 3, 5, 15
Information on How to Apply for NASA Microgravity Research Grants, 4	
J-Bars, 16	
JSC Institutional Review Board, 3, 14	
K-bottles, 16	